Supporting Information:

Hydrogen Bond Donors Influence On The Electrochemical Performance Of Composite Carbon Allotrope Electrodes/Deep Eutectic Solvents Interface

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Figure S1 Nitrogen adsorption–desorption isotherms of commercial graphene (a) and commercial graphite obtained at 77.3 K.

Figure S2: Electrochemical testing of graphene in R200 electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 $mV.\ s^{-1}$, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

Figure S3: Electrochemical testing of graphene in 1,2-propeline electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 $mV.\ s^{-1}$, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

Figure S4: Electrochemical testing of graphite in R200 electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 $mV.\ s^{-1}$, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

Figure S5: Electrochemical testing of graphite in 1,2-propeline electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 $mV.\ s^{-1}$, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

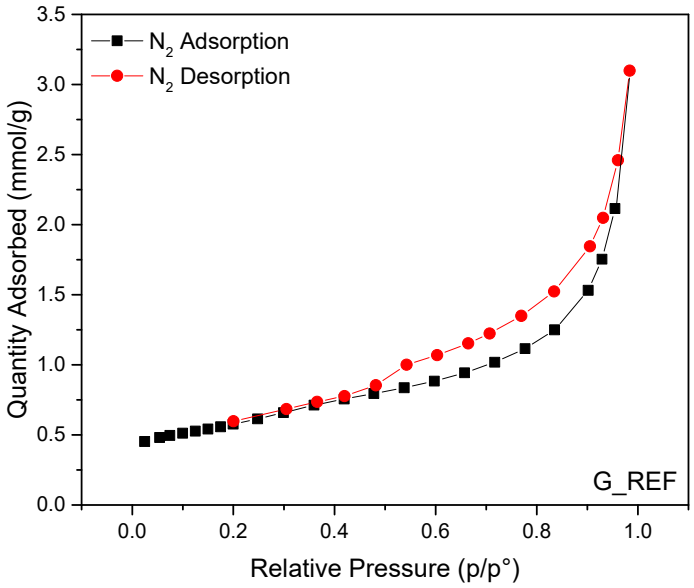
Figure S6: IR drop for both carbon materials and eutectic mixtures at temperatures between 30 and 60 °C.

Table S1: Temperature effect on capacitance (1^{st} cycle) for graphene and graphite in both eutectic mixtures.

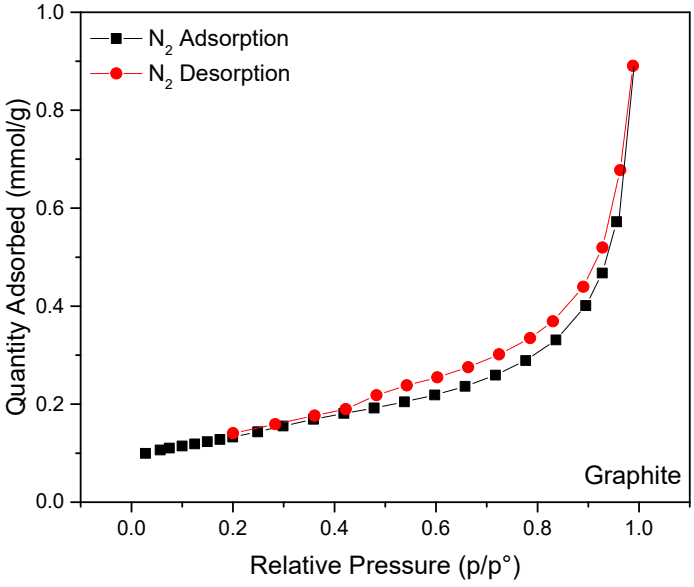
Table S2: Temperature effect on capacitance (1000^{th} cycle) for graphene and graphite in both eutectic mixtures.

Table S3: Temperature effect on IR drop for graphene and graphite in both eutectic mixtures.

- **BET**



(a)



(b)

Figure S1 Nitrogen adsorption–desorption isotherms of commercial graphene (a) and commercial graphite obtained at 77.3 K.

- **Graphene/R200 interface**

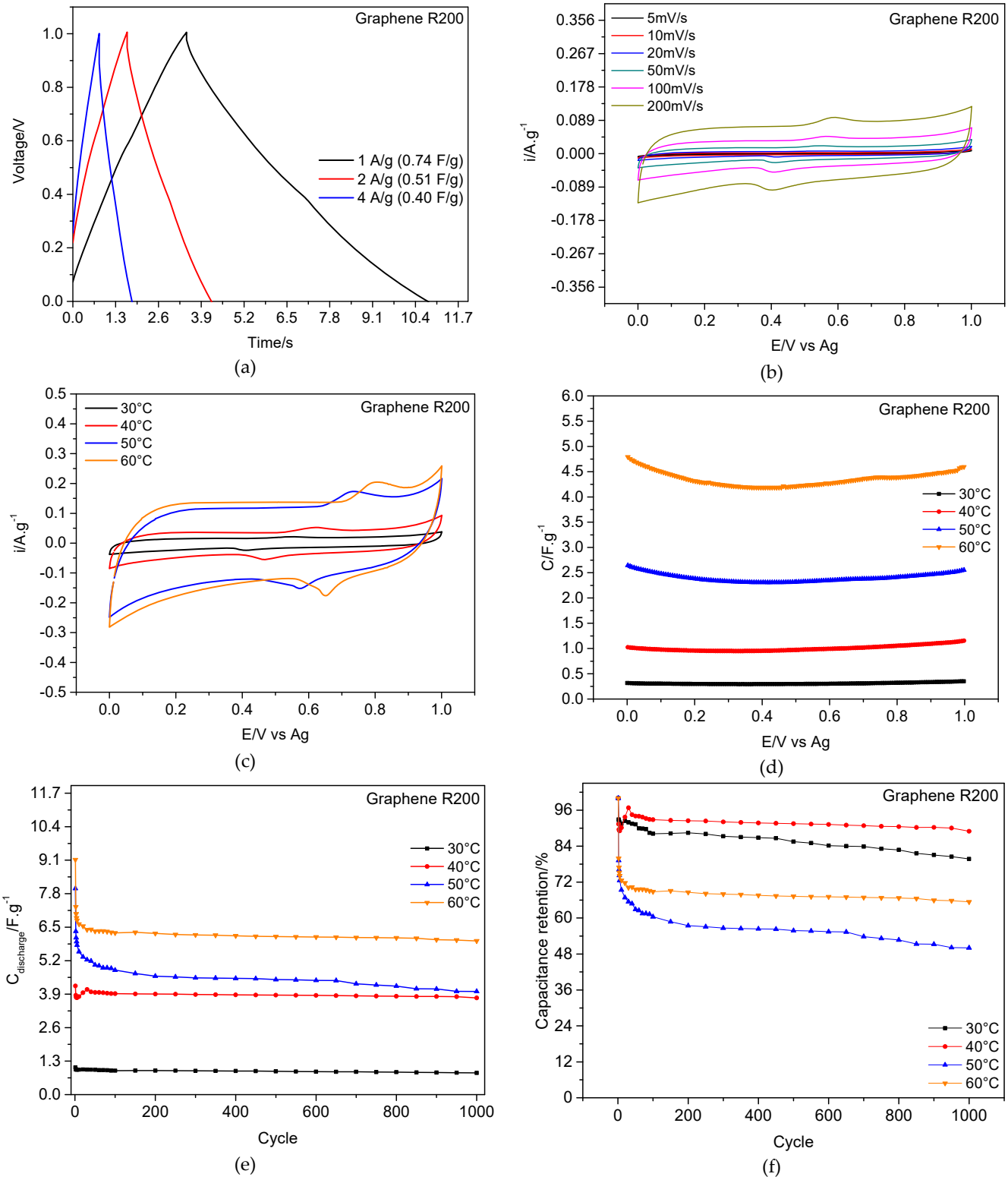


Figure S2: Electrochemical testing of graphene in R200 electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 A.g^{-1}. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 mV. s^{-1}, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

- **Graphene/1,2-Propeline interface**

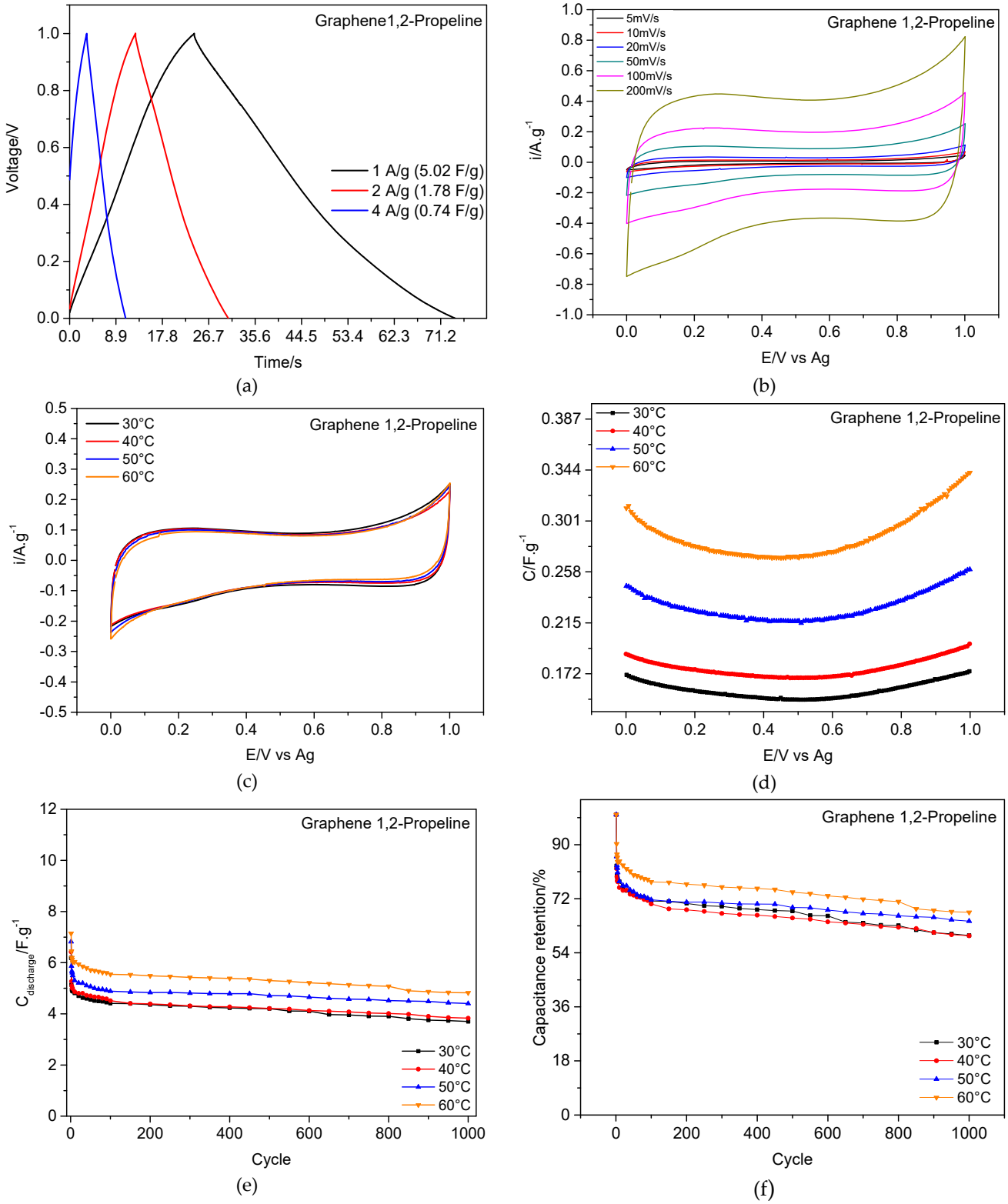


Figure S3: Electrochemical testing of graphene in 1,2-propeline electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 $mV.\ s^{-1}$, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

- **Graphite/R200 interface**

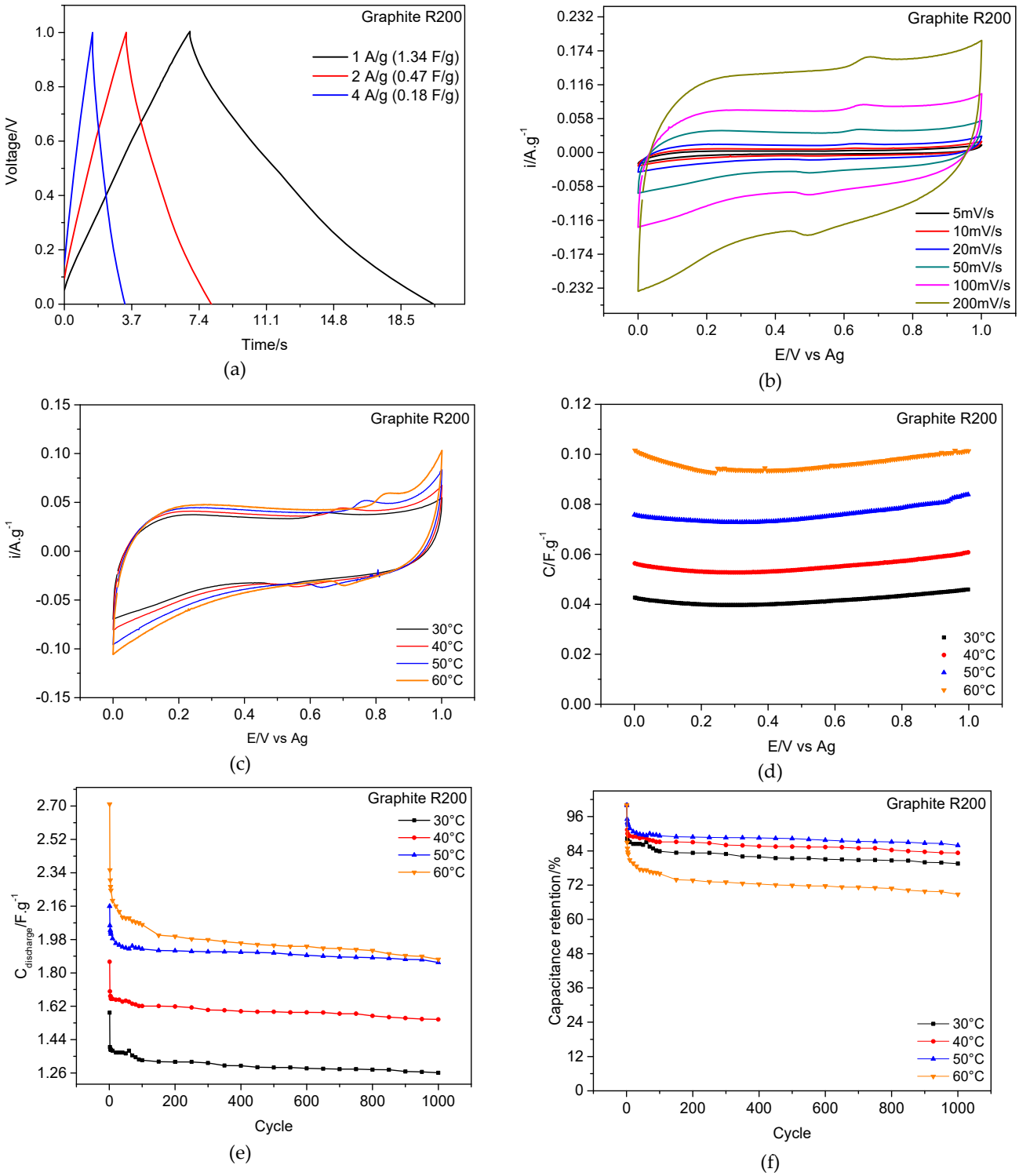


Figure S4: Electrochemical testing of graphite in R200 electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 mV. s^{-1}, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

- **Graphite/1,2-Propeline**

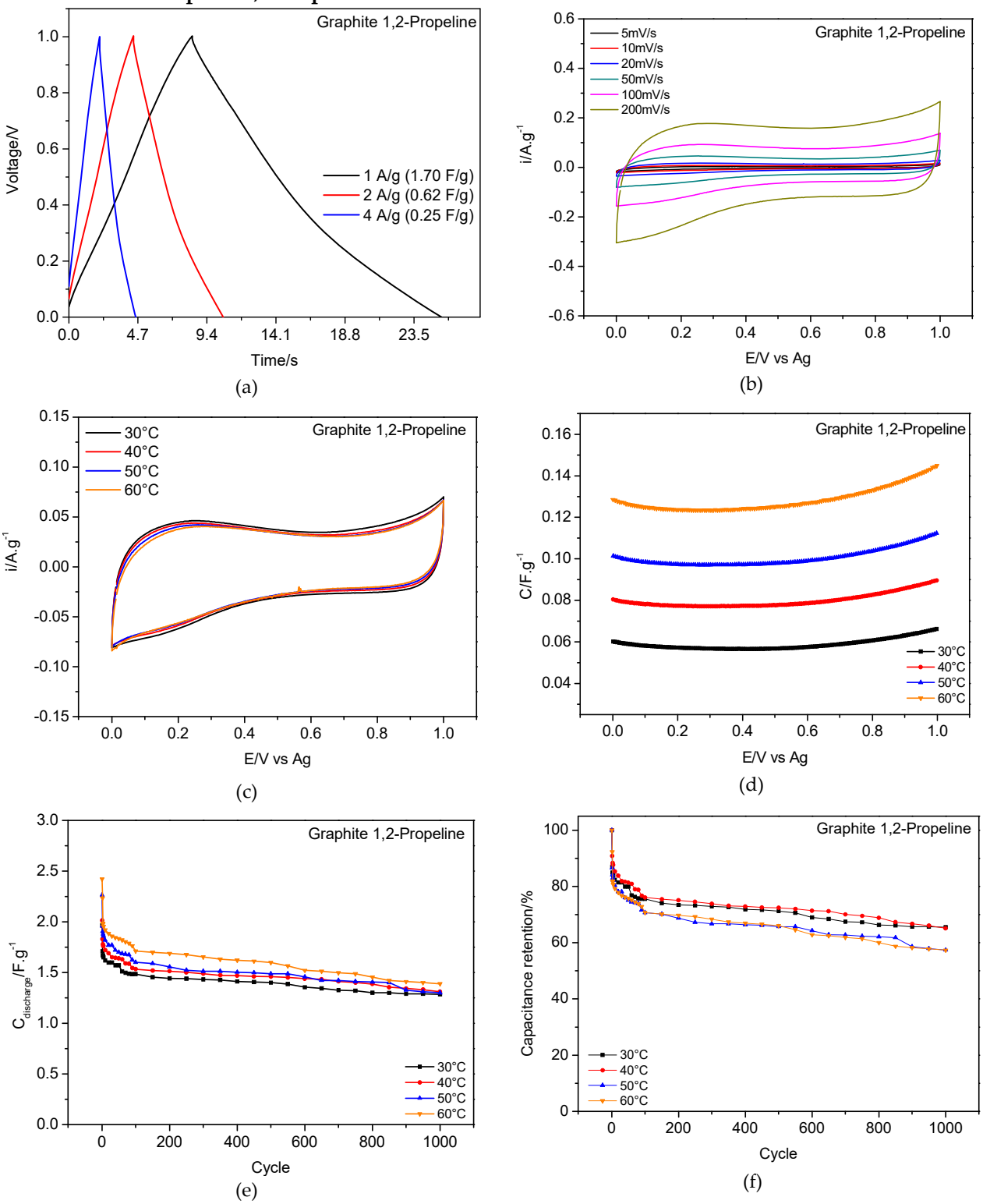


Figure S5: Electrochemical testing of graphite in 1,2-propeline electrolyte at 30 °C. a) galvanostatic charge-discharge curves recorded with current density 1, 2 and 4 $A.g^{-1}$. b) CV curves recorded at scan rates 5, 10, 20, 50, 100 and 200 $mV.\ s^{-1}$, temperature effect at 30, 40, 50 and 60 °C: c) cyclic voltammetry; d) capacitance-potential curve; e) discharge gravimetric capacitance for 1000 cycles; f) capacitance retention.

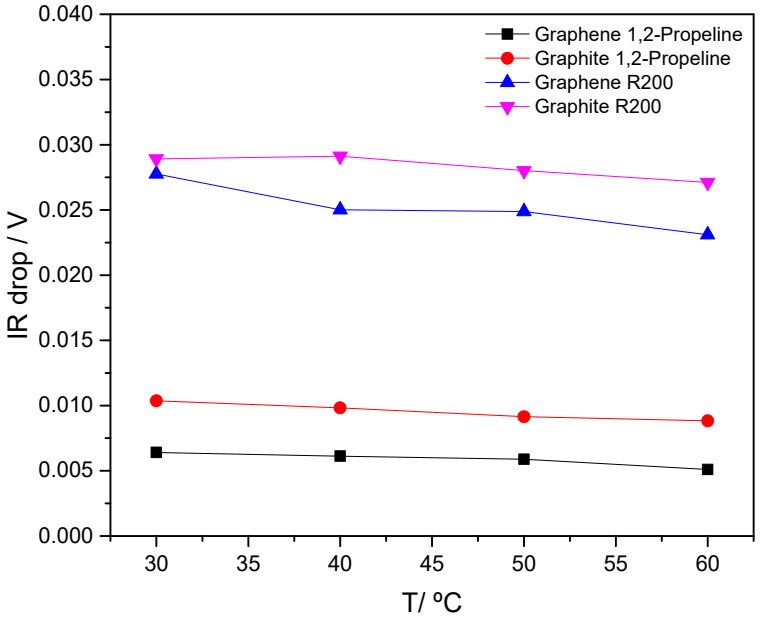


Figure S6: IR drop for both carbon materials and eutectic mixtures at temperatures between 30 and 60 °C.

Table S1: Temperature effect on capacitance (1st cycle) for graphene and graphite in both eutectic mixtures.

	G_REF 1,2-P	Graphite 1,2-P	G_REF R200	Graphite R200
T / °C		**IR drop / V**		
30	0.00641	0.0104	0.028	0.0289
40	0.00612	0.0098	0.025	0.0291
50	0.00589	0.0091	0.025	0.028
60	0.0051	0.0088	0.023	0.0271

Table S2: Temperature effect on capacitance (1000th cycle) for graphene and graphite in both eutectic mixtures.

1st cycle		**T/ °C**			
		30 °C	40 °C	50 °C	60 °C
		Capacitance / F. g^{-1}			
1,2-P	**G_REF**	5.02	6.43	6.82	7.16
	Graphite	1.7	2.02	2.27	2.42
R200	**G_REF**	0.74	4.22	8.1	9.01
	Graphite	1.34	1.86	2.16	2.71

Table S3: Temperature effect on IR drop for graphene and graphite in both eutectic mixtures.

1000th cycle*		**T/ °C**			
		30 °C	40 °C	50 °C	60 °C
		Capacitance / F. g^{-1}			
1,2-P	**G_REF**	4.79	4.21	4.71	5.3
	Graphite	1.29	1.46	1.49	1.61
R200	**G_REF**	0.69	3.86	4.46	6.13
	Graphite	1.29	1.59	1.91	1.95